

Applicant: Vesa Ahvenniemi et al.
PCT App. No.: PCT/FI2004/050168
Preliminary Amendment filed May 23, 2006

Claim Listing

1–12. (canceled)

13. (new) A method of tail threading in a web-forming machine, comprising the steps of:

forming a threading tail from a web;
monitoring the formation of the threading tail;
transferring the tail to a production section of the web-forming machine, the production section having a start and an end, the transferring taking place at a draw point which is at the start of the production section;
monitoring the transfer of the threading tail to the draw point at the start of the production section;
pulling the threading tail toward a holding point at the end of the production section;
monitoring the holding point and its environment; and
detecting the threading tail at the holding point and thus determining successful tail threading, wherein the formation of the threading tail, the transfer of the threading tail to the production section, and the holding point, are each monitored separately.

14. (new) The method of Claim 13 wherein an additional selected point of the production section of the web-forming machine is monitored.

15. (new) The method of Claim 13 wherein the tail threading is monitored by forming images, and further comprising the steps of:
storing the images so formed with a time-specific image information; and
displaying said images synchronized with a particular point in the threading tail.

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16. (new) The method of Claim 15, wherein when deviations appear in the tail threading, determining a location of a problem point on the basis of the stored images.

17. (new) The method of Claim 16, wherein the location of the problem point is determined on the basis of a distance the threading tail has progressed, calculated from time-specific image information, which distance is applied to the monitored production section of the web-forming machine.

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18. (new) An arrangement for tail threading in a web-forming machine, comprising:

- a plurality of sequential production sections;
- a first production section of the plurality of sequential production sections having a means for cutting a threading tail from the web being formed on the web-forming machine;
- a second production section of the plurality of sequential production sections following in sequence the first production section, the second production section having a start, and a means for threading a threading tail through the second production section, which means for threading forms a first draw point at the start of the second production section;
- a means for transferring a threading tail from the first production section to the means for threading of the second production section;
- wherein the second production section has an end which defines a holding point, to which the means for threading extends;
- control equipment arranged in controlling connection to the means for cutting a threading tail, the means for transferring the threading tail, and the means for threading the threading tail;
- a first camera device arranged for collecting time-specific image information of formation of a threading tail by the means for cutting a threading tail;
- a second camera device arranged for collecting time-specific image information of the means for transferring a threading tail at the first draw point;
- a third camera device arranged for collecting time-specific image information of the holding point; and
- memory devices connected in image storing relation to the first camera device, the second camera device, and the third camera device for storing time-specific image information collected using the first camera device, the second camera device and the third camera device, the memory devices connected to a display device such that images captured by the first camera device, the second camera device and the third camera device can be displayed in a selected manner.

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19. (new) The apparatus of claim 18 further comprising a fourth camera device arranged for collecting time-specific image information of a selected point in the plurality of sequential production sections, the fourth camera device connected in time-specific image information supplying relation to the memory devices, the memory devices connected to the display device such that images captured by the fourth camera device can be displayed in a selected manner.

20. The apparatus of claim 19, wherein the memory devices are connected to the control equipment so as to combine the properties of the production section of the web-forming machine and the image information.

21. (new) The apparatus of claim 18, wherein the first camera device, the second camera device, and the third camera device are connected to the memory devices arranged as a single system which stores the time-specific image information of each of the first camera device, the second camera device, and the third camera device, so that such time-specific image information can be processed and examined during or after a tail threading of each sequential production section.

22. (new) The apparatus of claim 18, wherein each of the first camera device, the second camera device, and the third camera is a digital high-speed camera.

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23. (new) A method of tail threading in a web-forming machine, comprising the steps of:

forming a threading tail from a web;
imaging to form first images of the formation of the threading tail with a first camera and storing with a time reference said first images;
transferring the tail to a production section of the web-forming machine, the production section having a start and an end, the transferring taking place at a draw point which is at the start of the production section;
imaging to form second images with a camera the transfer of the threading tail to the draw point at the start of the production section and storing with a time reference said second images;
pulling the threading tail toward a holding point at the end of the production section;
imaging to form third images the holding point and its environment and storing with a time reference said third images;
displaying on a monitor said first, second and third images, each said image of the images synchronized with a particular point in the threading tail; and
detecting the threading of the tail in the third images to determine successful tail threading.

24. (new) The method of claim 23 wherein an additional selected point of the production section of the web-forming machine is imaged with a camera to form fourth images and further comprising the step of storing with a time reference said fourth images and displaying on the monitor said four images synchronized with the particular point in the threading tail.

25. (new) The method of claim 24, wherein when deviations appear in the tail threading, the location of a problem point is determined on the basis of the stored images.

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26. (new) The method of claim 25, wherein the location of the problem point is determined on the basis of a distance the threading tail has progressed calculated from the time reference of the image information, which distance is applied to the monitored production section of the web-forming machine.

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27. (new) A method of tail threading in a web-forming machine of a selected geometry and a selected web speed therethrough; the method comprising the steps of:

forming a threading tail from a web;

imaging to form first images the formation of the threading tail with a first camera and storing with a time reference said first images, the first camera recording a tail threading start time and each time at which a change takes place in the first images;

transferring the tail to a production section of the web-forming machine, the production section having a start and an end, the transferring taking place at a draw point which is at the start of the production section;

imaging to form second images with a camera the transfer of the threading tail to the draw point at the start of the production section and storing with a time reference said second images, the second camera recording the tail threading start time and each time at which a change takes place in the second images;

pulling the threading tail toward a holding point at the end of the production section;

imaging to form third images the holding point and its environment and storing with a time reference said third images, the third camera recording the tail threading start time and each time at which a change takes place in the third images;

determining a time line of locations of the threading tail as a function of time based on the selected geometry and the selected speed of progress through the web-forming machine;

determining a location of a problem point by detecting a time of slackening of the tail at the draw point in the images from the second camera; and

using the time line to calculate the problem point location.

28. (new) The method of Claim 27, wherein an additional selected point of the production section of the web-forming machine is imaged.